



1196 Borregas Ave., Sunnyvale, CA 94089-1302, USA
Tel: +1 (408) 542-5200, Fax: +1 (408) 542-5300

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

May 4, 2000

RE: Response to FCC Requests
Correspondence Reference Numbers: 13472
FCC IDs: HZB-S58-04
Form 731 Confirmation Numbers: EA96458

Attn: Joe Dichoso

Dear Mr. Dichoso:

This is in response to your request 13472.

- 1, 4 Please see attachment 1, which I will upload separately, for our previous responses to the Commission's request for processing gain. Please also find the test report of the process gain document as attached at the end of this letter. The processing gain compliance is demonstrated using the method as described in part 15.247 (e) (2). All measurements are above 10dB; therefore, there was no requirement to delete worst case 20% data points.

It is difficult to determine the theoretical processing gain when multiple coding technologies are implemented in combination with spreading, all of which contribute to the improvement to the received signal to noise ratio. We believe the processing gain definition given by many textbooks where spread spectrum technology is discussed alone is over simplified for our technology and can not accurately describe the improvement to the received signal to noise ratio of our system. As we have expressed in our previous letters to the Commission, and have been accepted numerous times by the Commission in our previous applications, we believe the demonstration of the specification by means of Commission-approved test procedures should acknowledge the compliance of any device. We are interested in research on the theoretical processing gain in a complex system where spread spectrum technology is implemented in combination with other technologies, and are willing to discuss and research with the Commission on this issue in the future independent of the equipment approval.

- 2 The maximum tested RF output power of the radio is 209mW (23.2dBm). The device should be granted approval for operation at the maximum output power with up to 41dBi-gain antenna. As we have indicated in our previous response, when 3.5dB cable loss or more is used with such a system, the use of the radio at 23.2dBm output with antennas up to 41dBi gain result in a less than 1640W EIRP. Therefore, 23.2dBm is the output power that corresponds with any antennas in the list. In real applications, there are many cases where the radio is used at a reduced output power.
- 3 We understand your position in regards to panel antennas. We do not plan to additionally test the radio with a panel antenna at this time.

Thank you for your comment on “Occupational/Controlled exposure”. In the case of our products, we do require professional installers to put up our system, and the installers must be trained and they do have or should have knowledge necessary to control their exposure conditions. However, since our system complies with the limit set for the uncontrolled environment with significant margins, we are not significantly concerned about the differences between controlled and uncontrolled environment. We will delete that statement from all future submissions to the Commission.

I hope I have addressed all questions in your request.

Yours truly,

A handwritten signature in black ink, appearing to read 'Caroline Yu', with a stylized, flowing script.

Caroline Yu

International Product Manager
Western Multiplex Corporation

Processing Gain Test for HZB-S58-04 (Model 31260)

Test Setup:

The processing gain was measured using the CW jamming margin method as described in 15.247(e)(2). The specific test diagram is illustrated below.

All test equipment and the EUT were allowed to warm up for four hours prior to start of test to minimize drift over time. All test equipment had valid calibration. Calibration of carrier and interferer levels was performed several times during testing with no observed changes.

The measurements were performed on the frequency channel centered at 5750 MHz, over a range of ± 5.0 MHz. The measurements made across the center ± 3.0 MHz should be used for calculation of G_p since that bandwidth represents the receiver passband.

For the carrier signal, a level approximately 40 dB above threshold was chosen so that thermal noise would not effect the processing gain measurements. The measured threshold of the receive radio was ~ -94 dBm at $BER = 1 \times 10^{-6}$, the signal level of the transmit radio was -58.6 dBm measured at the input of the receive radio, (P_s). For the jammer signal, -40 dBm at the generator (P_g) corresponds to -55.8 dBm (P_j) at the receiver input. It is these numbers that were used for calculating C/I and G_p .

Test Equipment:

Signal Generator	Hewlett Packard 83731A
Power Meter	HP437B/8484A
BER Test Set	Fireberd 6000

Explanation of Results:

The following notations are used on the spreadsheet data:

P_g: Power at Generator in dBm (as indicated by generator display).

P_j: Power of interferer at the receiver input.(calculated in spreadsheet)

P_s: Power of carrier at receiver input (initial calibration).

J/S: Jammer to Signal ratio, $P_j - P_s$ (dB) (calculated in spreadsheet)

G_p: Processing Gain: $(S/N)_o + J/S + L_{sys}$ where:

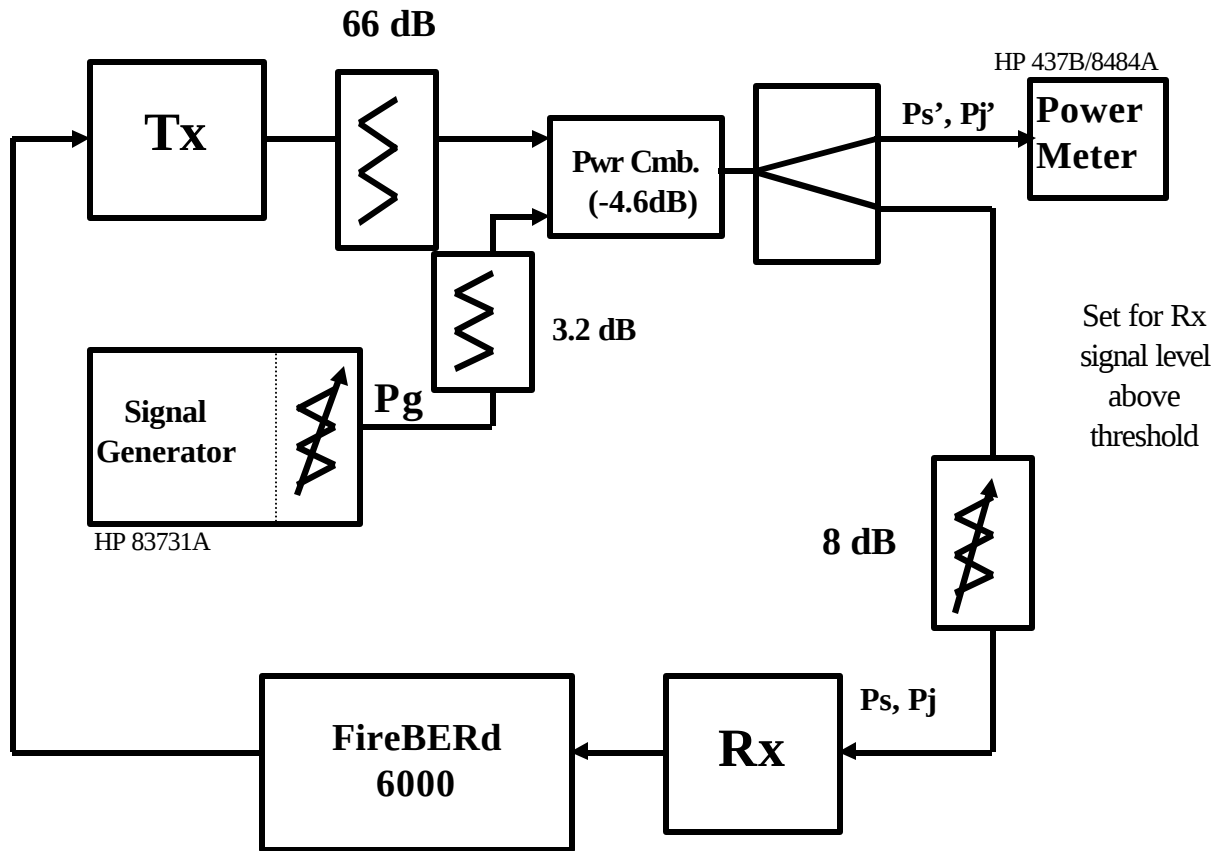
$L_{sys} = 2$ dB

$(S/N)_o = 13.5$ dB for QPSK and $BER = 10^{-6}$ (see curve provided)

therefore: $G_p = 13.5 + 2 + J/S = 15.5 + J/S$ (calculated in spreadsheet)

100% of measurements meet the minimum processing gain of 10 dB.

Processing Gain Test Equipment Setup



5.750 GHz 4 Mbps LYNX-SC6 Processing Gain Measurement 12/3/99

meas #	f MHz	Gp dBm	Pj dBm	Pg dBm	Ps dBm	J/S dB
1	5745	39.2	-34.9	-19.1	-58.6	23.7
2	5745.05	38.1	-36	-20.2	-58.6	22.6
3	5745.1	38.2	-35.9	-20.1	-58.6	22.7
4	5745.15	38.3	-35.8	-20	-58.6	22.8
5	5745.2	38.4	-35.7	-19.9	-58.6	22.9
6	5745.25	38.3	-35.8	-20	-58.6	22.8
7	5745.3	38.2	-35.9	-20.1	-58.6	22.7
8	5745.35	38.3	-35.8	-20	-58.6	22.8
9	5745.4	38.1	-36	-20.2	-58.6	22.6
10	5745.45	38.1	-36	-20.2	-58.6	22.6
11	5745.5	38	-36.1	-20.3	-58.6	22.5
12	5745.55	37.5	-36.6	-20.8	-58.6	22
13	5745.6	37.3	-36.8	-21	-58.6	21.8
14	5745.65	37.4	-36.7	-20.9	-58.6	21.9
15	5745.7	36.6	-37.5	-21.7	-58.6	21.1
16	5745.75	36	-38.1	-22.3	-58.6	20.5
17	5745.8	35.8	-38.3	-22.5	-58.6	20.3
18	5745.85	35.1	-39	-23.2	-58.6	19.6
19	5745.9	34.3	-39.8	-24	-58.6	18.8
20	5745.95	33.8	-40.3	-24.5	-58.6	18.3
21	5746	32.6	-41.5	-25.7	-58.6	17.1
22	5746.05	31.7	-42.4	-26.6	-58.6	16.2
23	5746.1	31	-43.1	-27.3	-58.6	15.5
24	5746.15	29.7	-44.4	-28.6	-58.6	14.2
25	5746.2	28.4	-45.7	-29.9	-58.6	12.9
26	5746.25	27.5	-46.6	-30.8	-58.6	12
27	5746.3	26.2	-47.9	-32.1	-58.6	10.7
28	5746.35	25.2	-48.9	-33.1	-58.6	9.7
29	5746.4	24.2	-49.9	-34.1	-58.6	8.7
30	5746.45	22.9	-51.2	-35.4	-58.6	7.4
31	5746.5	21.9	-52.2	-36.4	-58.6	6.4
32	5746.55	21.1	-53	-37.2	-58.6	5.6
33	5746.6	20.1	-54	-38.2	-58.6	4.6
34	5746.65	19.2	-54.9	-39.1	-58.6	3.7
35	5746.7	18.3	-55.8	-40	-58.6	2.8
36	5746.75	17.6	-56.5	-40.7	-58.6	2.1
37	5746.8	17.1	-57	-41.2	-58.6	1.6
38	5746.85	16.4	-57.7	-41.9	-58.6	0.9
39	5746.9	15.6	-58.5	-42.7	-58.6	0.1
40	5746.95	15.4	-58.7	-42.9	-58.6	-0.1
41	5747	15.1	-59	-43.2	-58.6	-0.4
42	5747.05	14.7	-59.4	-43.6	-58.6	-0.8
43	5747.1	14.4	-59.7	-43.9	-58.6	-1.1
44	5747.15	14.1	-60	-44.2	-58.6	-1.4
45	5747.2	13.8	-60.3	-44.5	-58.6	-1.7
46	5747.25	13.8	-60.3	-44.5	-58.6	-1.7

47	5747.3	13.7	-60.4	-44.6	-58.6	-1.8
48	5747.35	13.4	-60.7	-44.9	-58.6	-2.1
49	5747.4	13.2	-60.9	-45.1	-58.6	-2.3
50	5747.45	13.1	-61	-45.2	-58.6	-2.4
51	5747.5	13.2	-60.9	-45.1	-58.6	-2.3
52	5747.55	13	-61.1	-45.3	-58.6	-2.5
53	5747.6	12.9	-61.2	-45.4	-58.6	-2.6
54	5747.65	12.8	-61.3	-45.5	-58.6	-2.7
55	5747.7	12.9	-61.2	-45.4	-58.6	-2.6
56	5747.75	13	-61.1	-45.3	-58.6	-2.5
57	5747.8	12.9	-61.2	-45.4	-58.6	-2.6
58	5747.85	12.7	-61.4	-45.6	-58.6	-2.8
59	5747.9	12.7	-61.4	-45.6	-58.6	-2.8
60	5747.95	12.9	-61.2	-45.4	-58.6	-2.6
61	5748	12.8	-61.3	-45.5	-58.6	-2.7
62	5748.05	12.6	-61.5	-45.7	-58.6	-2.9
63	5748.1	12.6	-61.5	-45.7	-58.6	-2.9
64	5748.15	12.6	-61.5	-45.7	-58.6	-2.9
65	5748.2	12.6	-61.5	-45.7	-58.6	-2.9
66	5748.25	12.7	-61.4	-45.6	-58.6	-2.8
67	5748.3	12.5	-61.6	-45.8	-58.6	-3
68	5748.35	12.5	-61.6	-45.8	-58.6	-3
69	5748.4	12.6	-61.5	-45.7	-58.6	-2.9
70	5748.45	12.6	-61.5	-45.7	-58.6	-2.9
71	5748.5	12.5	-61.6	-45.8	-58.6	-3
72	5748.55	12.3	-61.8	-46	-58.6	-3.2
73	5748.6	12.3	-61.8	-46	-58.6	-3.2
74	5748.65	12.3	-61.8	-46	-58.6	-3.2
75	5748.7	12.2	-61.9	-46.1	-58.6	-3.3
76	5748.75	12.1	-62	-46.2	-58.6	-3.4
77	5748.8	12	-62.1	-46.3	-58.6	-3.5
78	5748.85	12	-62.1	-46.3	-58.6	-3.5
79	5748.9	12.2	-61.9	-46.1	-58.6	-3.3
80	5748.95	12.1	-62	-46.2	-58.6	-3.4
81	5749	11.9	-62.2	-46.4	-58.6	-3.6
82	5749.05	12	-62.1	-46.3	-58.6	-3.5
83	5749.1	12.1	-62	-46.2	-58.6	-3.4
84	5749.15	12	-62.1	-46.3	-58.6	-3.5
85	5749.2	11.9	-62.2	-46.4	-58.6	-3.6
86	5749.25	11.7	-62.4	-46.6	-58.6	-3.8
87	5749.3	11.6	-62.5	-46.7	-58.6	-3.9
88	5749.35	11.7	-62.4	-46.6	-58.6	-3.8
89	5749.4	11.5	-62.6	-46.8	-58.6	-4
90	5749.45	11.3	-62.8	-47	-58.6	-4.2
91	5749.5	11.2	-62.9	-47.1	-58.6	-4.3
92	5749.55	11.2	-62.9	-47.1	-58.6	-4.3
93	5749.6	11.2	-62.9	-47.1	-58.6	-4.3
94	5749.65	11.1	-63	-47.2	-58.6	-4.4
95	5749.7	10.9	-63.2	-47.4	-58.6	-4.6
96	5749.75	10.8	-63.3	-47.5	-58.6	-4.7
97	5749.8	10.9	-63.2	-47.4	-58.6	-4.6
98	5749.85	10.8	-63.3	-47.5	-58.6	-4.7
99	5749.9	10.6	-63.5	-47.7	-58.6	-4.9

100	5749.95	10.5	-63.6	-47.8	-58.6	-5
101	5750	10.5	-63.6	-47.8	-58.6	-5
102	5750.05	10.7	-63.4	-47.6	-58.6	-4.8
103	5750.1	10.7	-63.4	-47.6	-58.6	-4.8
104	5750.15	10.6	-63.5	-47.7	-58.6	-4.9
105	5750.2	10.7	-63.4	-47.6	-58.6	-4.8
106	5750.25	10.9	-63.2	-47.4	-58.6	-4.6
107	5750.3	11.1	-63	-47.2	-58.6	-4.4
108	5750.35	11.1	-63	-47.2	-58.6	-4.4
109	5750.4	11.1	-63	-47.2	-58.6	-4.4
110	5750.45	11.2	-62.9	-47.1	-58.6	-4.3
111	5750.5	11.4	-62.7	-46.9	-58.6	-4.1
112	5750.55	11.5	-62.6	-46.8	-58.6	-4
113	5750.6	11.4	-62.7	-46.9	-58.6	-4.1
114	5750.65	11.5	-62.6	-46.8	-58.6	-4
115	5750.7	11.6	-62.5	-46.7	-58.6	-3.9
116	5750.75	11.8	-62.3	-46.5	-58.6	-3.7
117	5750.8	11.9	-62.2	-46.4	-58.6	-3.6
118	5750.85	11.8	-62.3	-46.5	-58.6	-3.7
119	5750.9	11.8	-62.3	-46.5	-58.6	-3.7
120	5750.95	12	-62.1	-46.3	-58.6	-3.5
121	5751	12.1	-62	-46.2	-58.6	-3.4
122	5751.05	12	-62.1	-46.3	-58.6	-3.5
123	5751.1	12	-62.1	-46.3	-58.6	-3.5
124	5751.15	12	-62.1	-46.3	-58.6	-3.5
125	5751.2	12.1	-62	-46.2	-58.6	-3.4
126	5751.25	12.3	-61.8	-46	-58.6	-3.2
127	5751.3	12.2	-61.9	-46.1	-58.6	-3.3
128	5751.35	12.1	-62	-46.2	-58.6	-3.4
129	5751.4	12.3	-61.8	-46	-58.6	-3.2
130	5751.45	12.5	-61.6	-45.8	-58.6	-3
131	5751.5	12.5	-61.6	-45.8	-58.6	-3
132	5751.55	12.5	-61.6	-45.8	-58.6	-3
133	5751.6	12.5	-61.6	-45.8	-58.6	-3
134	5751.65	12.7	-61.4	-45.6	-58.6	-2.8
135	5751.7	12.8	-61.3	-45.5	-58.6	-2.7
136	5751.75	12.7	-61.4	-45.6	-58.6	-2.8
137	5751.8	12.6	-61.5	-45.7	-58.6	-2.9
138	5751.85	12.6	-61.5	-45.7	-58.6	-2.9
139	5751.9	12.7	-61.4	-45.6	-58.6	-2.8
140	5751.95	12.7	-61.4	-45.6	-58.6	-2.8
141	5752	12.7	-61.4	-45.6	-58.6	-2.8
142	5752.05	12.6	-61.5	-45.7	-58.6	-2.9
143	5752.1	12.7	-61.4	-45.6	-58.6	-2.8
144	5752.15	12.9	-61.2	-45.4	-58.6	-2.6
145	5752.2	12.9	-61.2	-45.4	-58.6	-2.6
146	5752.25	12.8	-61.3	-45.5	-58.6	-2.7
147	5752.3	12.8	-61.3	-45.5	-58.6	-2.7
148	5752.35	12.8	-61.3	-45.5	-58.6	-2.7
149	5752.4	13	-61.1	-45.3	-58.6	-2.5
150	5752.45	12.9	-61.2	-45.4	-58.6	-2.6
151	5752.5	12.7	-61.4	-45.6	-58.6	-2.8
152	5752.55	12.9	-61.2	-45.4	-58.6	-2.6

153	5752.6	13.1	-61	-45.2	-58.6	-2.4
154	5752.65	13.1	-61	-45.2	-58.6	-2.4
155	5752.7	13.2	-60.9	-45.1	-58.6	-2.3
156	5752.75	13.3	-60.8	-45	-58.6	-2.2
157	5752.8	13.5	-60.6	-44.8	-58.6	-2
158	5752.85	13.8	-60.3	-44.5	-58.6	-1.7
159	5752.9	13.9	-60.2	-44.4	-58.6	-1.6
160	5752.95	14	-60.1	-44.3	-58.6	-1.5
161	5753	14.4	-59.7	-43.9	-58.6	-1.1
162	5753.05	14.6	-59.5	-43.7	-58.6	-0.9
163	5753.1	15	-59.1	-43.3	-58.6	-0.5
164	5753.15	15.5	-58.6	-42.8	-58.6	0
165	5753.2	15.8	-58.3	-42.5	-58.6	0.3
166	5753.25	16.3	-57.8	-42	-58.6	0.8
167	5753.3	17.3	-56.8	-41	-58.6	1.8
168	5753.35	17.9	-56.2	-40.4	-58.6	2.4
169	5753.4	18.7	-55.4	-39.6	-58.6	3.2
170	5753.45	19.6	-54.5	-38.7	-58.6	4.1
171	5753.5	20.6	-53.5	-37.7	-58.6	5.1
172	5753.55	21.9	-52.2	-36.4	-58.6	6.4
173	5753.6	22.8	-51.3	-35.5	-58.6	7.3
174	5753.65	23.6	-50.5	-34.7	-58.6	8.1
175	5753.7	25.2	-48.9	-33.1	-58.6	9.7
176	5753.75	26.2	-47.9	-32.1	-58.6	10.7
177	5753.8	27.2	-46.9	-31.1	-58.6	11.7
178	5753.85	28.8	-45.3	-29.5	-58.6	13.3
179	5753.9	29.5	-44.6	-28.8	-58.6	14
180	5753.95	30.5	-43.6	-27.8	-58.6	15
181	5754	32.3	-41.8	-26	-58.6	16.8
182	5754.05	32.8	-41.3	-25.5	-58.6	17.3
183	5754.1	33.4	-40.7	-24.9	-58.6	17.9
184	5754.15	34.9	-39.2	-23.4	-58.6	19.4
185	5754.2	35.2	-38.9	-23.1	-58.6	19.7
186	5754.25	35.7	-38.4	-22.6	-58.6	20.2
187	5754.3	36.9	-37.2	-21.4	-58.6	21.4
188	5754.35	36.7	-37.4	-21.6	-58.6	21.2
189	5754.4	37	-37.1	-21.3	-58.6	21.5
190	5754.45	38.8	-35.3	-19.5	-58.6	23.3
191	5754.5	38.8	-35.3	-19.5	-58.6	23.3
192	5754.55	38.7	-35.4	-19.6	-58.6	23.2
193	5754.6	40.7	-33.4	-17.6	-58.6	25.2
194	5754.65	40.8	-33.3	-17.5	-58.6	25.3
195	5754.7	41	-33.1	-17.3	-58.6	25.5
196	5754.75	43.5	-30.6	-14.8	-58.6	28
197	5754.8	43.4	-30.7	-14.9	-58.6	27.9
198	5754.85	43.4	-30.7	-14.9	-58.6	27.9
199	5754.9	46.7	-27.4	-11.6	-58.6	31.2
200	5754.95	46.8	-27.3	-11.5	-58.6	31.3
201	5755	46.7	-27.4	-11.6	-58.6	31.2

Gp (dB)

